LYMANTRIIDAE

1011 *Dasychira bhana* Moore—Common.

EUPTEROTIDAE

69 *Eupterote fabia* Cr.—Fairly common.

BRAHMAEIDAE

32 *Brahmaea wallichii* Gray—Fairly common.

SPHINGIDAE

S 32 *Clanis deucalion* Wlk.—One.
S 70 *Haemorrhagia saundersi* Wlk.—One.
S 84 *Ampelophaga rubiginosa* Brem., *fasciosa* Moore—One.
S 118 *Macroglossum bombylans* Bsd.—One.
S 155 *Theretra nessus* Drury—Fairly common.
S 164 *Theretra oldenlandiae* F.—One.
S 178 *Rhagastis albomarginatus* Roths.—Not uncommon.

NOTODONTIDAE

1049 *Gazalina chrysolopha* Koll.—Fairly common. (N.B.—This species is not a Lymantriid.)

NOCTUIDAE

1968 *Diphtherocome discibrunnea* Moore—One.
1726 *Euplexia semifascia* Wlk., *cuprea* Moore—One.
2408 *Nyctipao glaucopis* Wlk.—Not uncommon.
2646 *Calpe ophideroides* Guen—Common.

GEOMETRIDAE

3516 *Abraxas sylvata* Scop.—One.

METHODS OF COLLECTION AND HATCHING OF CARP OVA IN CHITTAGONG WITH SOME SUGGESTIONS FOR THEIR IMPROVEMENT

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(*With 5 text figures*)

CONTENTS

Introduction

Bengal as a maritime province, rich in rivers, possesses an immense fisheries potential merely waiting to be tapped by scientific methods. As is fairly well known the major carps of this country, namely, Rohi (*Labeo rohita*), Catla (*Catla catla*), and Mrigal (*Cirrhina mrigala*) as well as others breed prolifically in rivers during the monsoon. But a fair quantity of the ova shed is carried down to saline waters in such rivers as are subjected to tidal influence. In other rivers, large quantities of spawn get blocked in nullahs, ditches and paddy fields, etc., after floods. In either case ova, larvae and fry capable of providing fish food to thousands of people perish owing to unfavourable physical conditions or are devoured by animals.

A start has already been made to save this food for the teeming millions as ova and larvae in larger numbers are collected from rivers to stock the innumerable stretches of cultivable waters scattered all over the country.

The spawn collectors of Chittagong use crude methods for the collection of ova from streams and for hatching. To examine the possibilities of improving upon these crude methods, I conducted investigations at the suggestion of Dr. S. L. Hora. The importance of the problem will be clear when it is known that in 1945 alone, 13,040 *handis* containing approximately 30,00,00,000 (30 crores) fry were exported from this area and about two thousand persons were actually engaged in the collection of ova and very many more in the hatching and transport of resultant fry. From the information now available it has been found that 10,160 *handis* of fry were exported from this district in 1946 and 11,799 *handis* in 1947.

I am indebted to Dr. S. L. Hora, Director of Zoological Survey of India (formerly Director of Fisheries, Bengal), for inviting me to investigate this important problem and for his guidance ungrudgingly given, whenever needed. I am also thankful to Messrs. M. Huq and Zain-ul-Abedin, Fishery Overseers of this Directorate, for their assistance during my investigations.

Main spawn collection centres

In this province there is a fairly established and flourishing fish fry trade. The important collecting centres of eggs, larvae and fry are numerous and far apart but for convenience of consideration are grouped into the following main zones by Rahman (p. 5):

(1) *Rajshahi zone*, comprising the left bank of the Padma (or the Ganges) covering a distance of about 60 miles from Godagari Ghat to Sarda and small pockets of rivers Jumna near Seraigani and the Padma near Raita.

(2) *Murshidabad zone*, comprising the right bank of the Padma, from Dhulian to Lalgola Ghat, a distance of about 40 miles, and also the whole length of the Bhagirathi which passes through Murshidabad and Nadia districts: and

(3) *Chittagong zone*, comprising the zig-zag course of the river Halda, a distance of about 16 miles within the Sadar subdivision. Unlike the first two zones fertilized ova only are collected here.

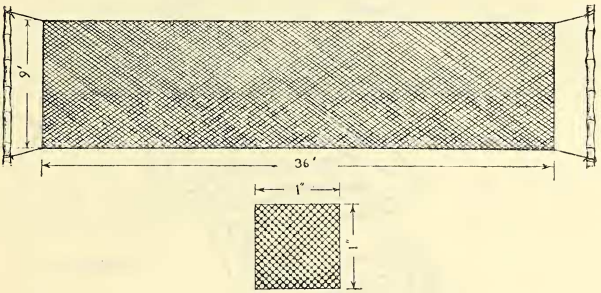
The investigations made in the third zone, viz., the river Halda and the information collected there form the subject matter of this short paper. The work done at the river is far from complete and will be continued until fairly complete success is achieved and the spawn collectors have learnt the improved technique.

In the first two zones larvae and fry of varying sizes are collected while in the third zone only fertilized ova are collected. Study of ova collected from the Halda in April, 1946, revealed that they were in various stages of development. The age of the most highly developed embryos collected from the stream, on comparison with the corresponding stages of some other fishes, was found to be about 12-14 hours. It was clear from the study that spawning had occurred about 12-14 hours earlier.

Here I wish to state that in the Halda maunds of eggs are shed every year and with the limited food supply in the river, one can safely say that if all the ova could be prevented from going to saline water or perishing otherwise, even then only a very small fraction of this number could be grown to maturity.

Description of collecting nets

The collecting net (Text-fig. 1) is a simple rectangular sheet of mosquito curtain measuring from 36-39 feet in length and 9 feet in depth. The sheet is laced with strong ropes all round. The shorter ends of the net are tied to two vertical bamboo poles, each about 8 feet in length (Text-fig. 1). The



Text-fig. 1.

two poles are held by two spawn collectors sitting at the opposite ends of the boat, to the sides of which the poles are fixed by the help of wooden hooks for additional support. The net is then lowered into the water in such a way that it remains behind the boat and does not get entangled. As soon as the net is lowered, by the force of the current, it forms a bag-like hollow in which ova collect. The net is lifted when sufficient ova gather. This process is repeated till a sufficient quantity of eggs are obtained.

Spawning grounds and collection areas

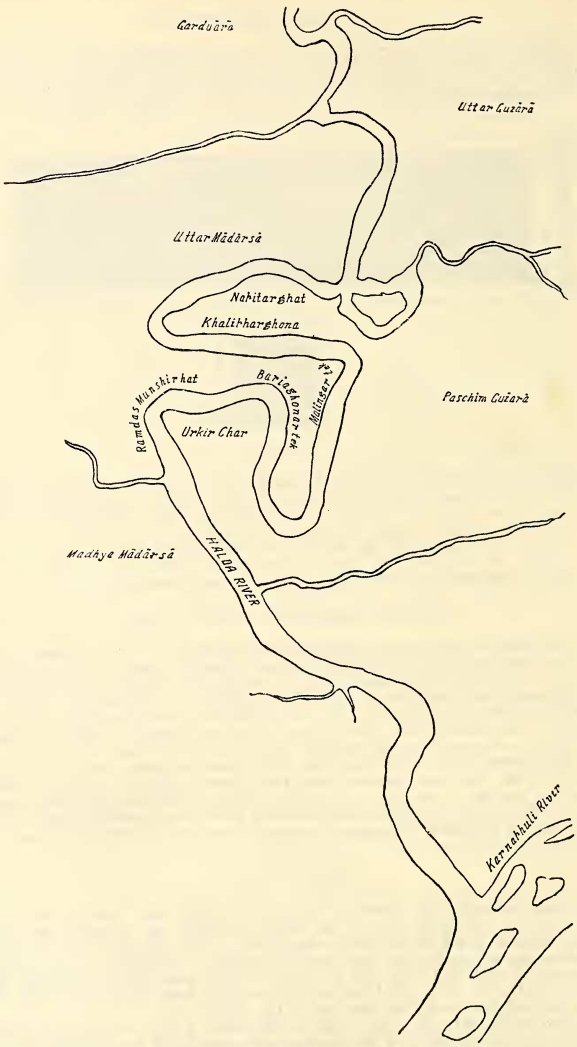
The major carps of the rivers breed at suitable places in freshwater and in the Halda at select places free from the influence of salinity. The favourite localities (Text-fig. 2), where the fish are said to breed are Napitarghat, Khalipharghona. Malingar tek and Bariaghonar tek. Mostly, the people of Paschim Guvarā, Urkirchar and Uttar Mādārsā, living on and near the banks of the Halda, collect the spawn. This area covers a distance of about 10 miles, extending from Napitarghat to Ramdas Munshirhat.

The spawn collectors fix their nets during the spawning season at suitable spots in the river and examine them after short intervals. As soon as some ova are spotted, it becomes clear that the fish are breeding or have already bred. The spawn is collected upto about 14 hours after spawning, after which the quantity of spawn decreases and further attempt at collection is not made.

Spawning season

'The spawning day generally falls within three days prior to or after full-moon or new-moon during the months of April to July, but the time for spawning is not fixed' (Majumdar, 1940 p. 735). There may be as many as four spawnings in the year, as for example, fish spawned on the 12th April, 10th and 26th May and 10th June in the year 1945, on the 1st and 30th April, 17th May and from the 10th to 12th June in the year 1946 and on the 23rd April and 23rd May during this year.

The belief that fish spawn only during night is not borne out by facts. The spawning in the bund at Bankura took place at 7 a.m. on the 14th of July, 1946, in the Halda about 5 p.m. on the 30th April, 1946. Further, *Labeo gonius* was seen spawning at 7.10 a.m. on the 20th July, 1933 (Ahmad,



Scale 1"=2 Miles

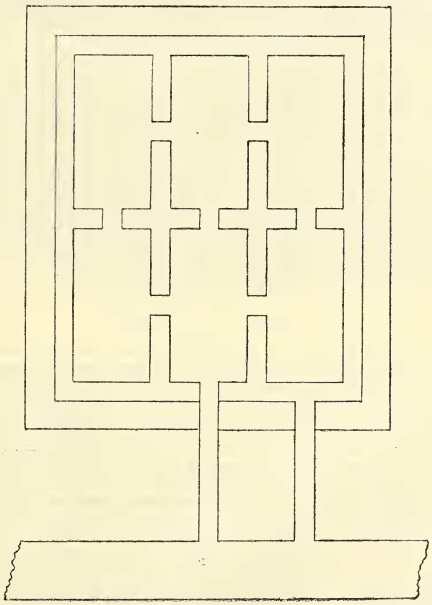
Text-fig. 2

1944, p. 344), and Khan (1945, pp. 316-18) and several other workers have also made similar observations. It is clear, therefore, that it is immaterial whether it is night or day, for fish shed ova as and when conditions become favourable. It seems to be true, however, that bright sunlight does not favour spawning, probably because it raises the temperature of the water and therefore the eggs are not laid during bright sunny days.

It has also been noticed that the fish settle at the bottom and do not show much sexual activity, when there is a heavy shower of rain. This may be due to the fact that heavy rain greatly agitates the water, making it unsuitable for the time being for shedding ova. After heavy rain, which brings about flood and is responsible for inundating low lying areas near the banks, the fish finding these and other favourable conditions migrate to the proper places to spawn.

Artificial beds (*Hapas*), their arrangement and description

Hapa (text-fig. 3) is the familiar vernacular term for beds scooped out on the banks of a river. The *hapas* referred to in this article are situated on the banks of the river Halda and its tributaries. A number of *hapas* are prepared at a place and are arranged according to the supply of water.



Text-fig. 3

In some places there are single rows of *hapas*, while in others there are double rows, one row lying on the river side and the other away from it. The front row of *hapas* is directly connected with the river either by a simple cutting in the earth or by bamboo pipes or by other types of wooden drains

while the second row gets water through the front row of *hapas* (text-fig. 3). The drains are used to fill water into the hapas when the level of water in the river is higher than in the hapas and for draining them, when the level of water is lower in the stream. That is how occasionally aeration of water in the *hapas* is maintained. Drainage system varies greatly in different cases but mostly the arrangement of *hapas* and the drainage system places is as shown in the figure.

The *hapas* can be used for one or more years depending upon the consistency of the soil in which these are formed. In loose soil the *hapas* are excavated annually but *hapas* in firm earth last several years. The *hapas* are properly plastered with mud and dried before they are used. Proper operation of the drainage is also ensured. Measurement of several hundred *hapas* established that their average dimensions were $16 \times 8 \times 1\frac{1}{2}$ feet.

Methods of collection

In the boat, the collectors erect two mud walls, enclosing a small area, making something like a small *hapa*. This enclosure is filled with water. In the enclosure thus formed eggs collected from the stream are transferred for development, which is accompanied, however, by a great loss of eggs owing to congestion and the want of proper aeration. The number of eggs so lost depends on the time factor. If eggs are collected in a short time and they are transferred to proper *hapas*, the mortality will be less but if collection takes a long time the result will be disastrous.

Condition of spawn at collection time

The ova at the time of collection are found to be in various stages of development. Each looks like a bead with a big balloon-like covering, formed as the result of suction of water into the space between the egg and its membrane. As the egg is slightly heavier than water, it settles down when shed in comparatively still water. The water absorbed serves as a medium for the protection of the developing embryo from external injuries as well as respiration before the larva hatches. After the embryo is almost fully formed this water serves yet another important function. The embryo here takes to swimming for the first time and there is no chance of its drowning. This is an important provision for the safety of the little ones before they come in direct touch with the external world. Thus, Nature has furnished a lesson to the fish farmers not to introduce the tiny, inexperienced and feeble larvae and fry straight-away into the deep water and endanger their very existence.

Methods of hatching

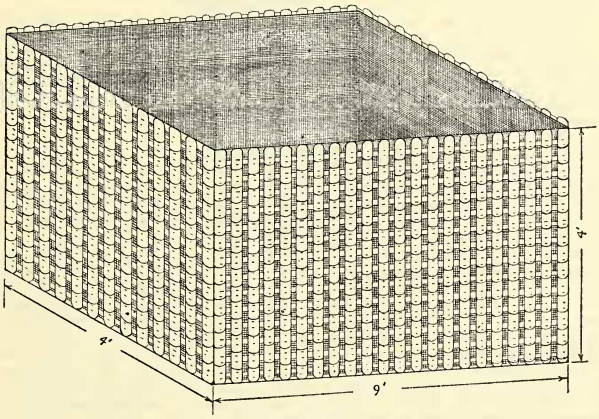
After sufficient quantity of eggs are collected from the river, these are transferred to the mud-enclosures in the boats and from the latter to the nets covering hapas, which are previously filled with water. For want of nets the same curtains are used for the collection as well as for hatching ova. The net on each hapa is allowed to sag about 6 inches below the surface of water while the rope lacing its margins is fixed to pegs on the banks at short distances, so that a bag-like hollow or depression is formed in the hapa. Below the bag a few strong bamboos are placed parallel to each other, along the breadth of the hapa. These bamboos are carefully rolled from time to time with a view to disturbing the eggs so that the ova may come to the surface. One hapa accommodates from 4 to 10 buckets (a bucket = 15 seers) of eggs, numbering 9,00,000 to 22,00,000. These eggs lie in several layers so that the lower layers are pressed hard. These ova are carefully and constantly moved by twigs so that the ova may get equal chance of development. The spawn when collected is a mixture of prawns, insect larvae, small fishes, etc. These useless creatures are not separated from the fish ova before transferring the latter to hapas. These animals move about actively in this confinement and injure the ova and some of them even devour them. Some of these also die in captivity and by their decomposition fungus makes its appearance and attacks the ova. There is no regular aeration of water in the hapa.

The ova remain on the nets and the water of the hapas is not changed till the larvae hatch out and pass through the meshes of the nets into the water of

the hapas below as free individuals. This may take about 24 hours or more for all the larvae to come out of the egg-membranes. When, however, most of the larvae hatch out, the nets with egg-shells, dead and decomposed eggs, dead and alive insect larvae, prawns and fish are removed and washed in the river. The fish larvae on the other hand remain in the water of the hapa till the second day, when these are collected with the help of closely woven sheet of cloth and introduced into another hapa containing fresh water. This procedure is repeated for a week or so. If instead of transferring larvae from one hapa to another a continuous current of water can be set up, the hatching percentage can be increased manifold. At some of the places there was no difficulty whatsoever in preparing such hapas.

During bright sunny days, the ova in the hapas are protected from the sun by placing on the hapas bamboo, covered by matting.

There is another method, which is used for the embryonic development only. Big bamboo baskets of various sizes and shapes are used for this purpose. These are lined internally with fine cloth and in the containers thus formed



Text-fig. 4

the ova collected from the stream are transferred. These baskets are locally known as 'Chang' (text-fig. 4). These are moored in the stream.

The embryos are allowed to develop here for some hours but are transferred to hapas before hatching takes place. The fry obtained by this process are supposed to be more healthy than those obtained as a result of entire development taking place in the hapas.

In the case of persons, who cannot afford to hire boats, ova are collected in another way. One of the shorter ends of the net in this case is tied to a pole fixed in the river while the opposite margin is held by a person standing near the bank. Thus sufficient quantity of ova are collected by these persons.

Results of some experiments

Some experiments were conducted on a small scale to determine the best method to get larger percentage of hatching. These experiments were not conclusive but at least it has become clear that careless handling of ova, crowding them on mosquito net, etc. and want of proper aeration are harmful and destructive to the proper development of eggs and larvae. The experiments are in progress, and the details will be published as soon as conclusive results are obtained.

Comparisons with methods employed in other places

From the river Halda (see map, text-fig. 2), and the bunds at Midnapore (Mookerjee, Mazumdar and Dasgupta 1944) the ova are collected with the help of mosquito curtain, which is bigger in Chittagong (from 36-39×9 feet) than in Midnapore (7½×3 feet). In the case of Bankura (Jamda Bundh), which was inspected in the month of July 1947, fine cloth 6×3 feet was used instead. The mosquito net cloth, however, gives better results because only the ova remain in the net while the water finds its way out, whereas in the case of fine cloth, it is often difficult to get rid of water and even at the time of collection the cloth interferes with the normal working. In a bundh at Chittagong (Majumdar, 1940 p. 737), the ova are not at all collected but are allowed to develop in the bundh itself.

Like the collecting nets, the hapas also differ in dimensions. In Chittagong the average dimensions were 16×8×1½ feet, in Midnapore, these were 4½×3×1½ feet while the dimensions were found to be only 3×2½×1 feet in Bankura. In none of these instances, however, there was any arrangement for setting up current of water in the hapas.

In Chittagong the *hapas* are covered by the mosquito curtains, which sag in water, and on this the ova are transferred. On the other hand, the ova are transferred directly into the *hapas* in the districts of Midnapore and Bankura. The first arrangement has some advantages over the second. Firstly, the ova can be orientated in such a way that most of them come to the surface. Secondly, after hatching, the larvae pass through the meshes of the curtain while the egg-membranes, dead eggs and other animals remain on the curtain and can be removed.

The number of ova put in one *hapa* greatly differs in the three localities. In Chittagong about 9 to 22 lakhs ova are put in one *hapa* whereas in Midnapore about 12,000 and in Bankura about 55,000 are treated in one *hapa*. If we take 5 mm. as the average diameter of an egg, about 4½ lakh ova can easily be spread in a single layer in a *hapa* at Chittagong, about fifty thousand in Midnapore and about twenty-seven thousand in Bankura.

Majumdar (1940) and Mookerjee, Mazumdar and Dasgupta (1944) have stressed the necessity of aerating *hapas* for better results. The results of the experiments conducted at Chittagong and Bankura support this view. The observations of Majumdar that ova are overcrowded in *hapas* in Chittagong were mostly found to be correct but the suggestion of Mookerjee, Mazumdar and Dasgupta that to avoid overcrowding only a cupful of eggs (about 1500) should be kept in each hapa, does not seem practicable in view of the large number of ova to be treated. Fifteen hundred ova will occupy only about 1/33 part of the space, if ova are arranged in one layer and so if their recommendation is followed the rest of the space will remain unused. In trout hatcheries at Katrain (Punjab), Harwan and Achhabal (Kashmir) and Avalanche (Madras), the ova are arranged in a single layer and all the space in the trays is properly utilised. The same practice can be followed in the present case with success.

Mookerjee, Mazumdar and Dasgupta have recommended the use of two sheets of cloth to keep the eggs in the pits, one piece to be spread on the top of the other, with a space in between the two. In order to keep the sheet of cloth in place, they have recommended the use of weights in the centre.

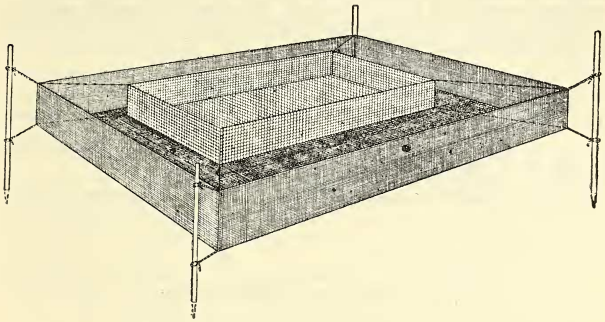
This is a useful suggestion but can further be improved. In the present case due to the weight in the centre, all ova will gather together in the bag-like structure formed in the centre and this overcrowding is harmful for the development of ova. The net can be made into a rectangular tank (text-fig. 5) like an inverted mosquito curtain, and all the four corners of the inner tank can be tied to the corresponding corners of the outer tank and the corners of the latter can be fastened to four upright poles of bamboo fixed for the purpose, so that both the tanks remain properly stretched and no bag-like structure is formed. When the ova are transferred to such improvised tanks, these will mostly remain in their proper positions and there will be no overcrowding at any one spot.

Mookerjee, Mazumdar and Dasgupta have recommended the use of plants such as *Ceratophyllum* and *Hydrilla* for promoting natural aeration in hapas. These plants will not be useful for two reasons:—

(1) In netting larvae they cause obstruction; and

(2) At night and on cloudy days these will reduce oxygen through respiration.

The principle followed in the case of trout hatcheries after suitable modifications will probably be the best course to follow in the present case.



Text-fig. 5.

Suggestions for improvements

(1) *Handis* or pucca earthen vessels should be used in place of mud-enclosures in the boats for usually a lot of mud dissolves in water, rendering the water muddy and injurious for the development of ova and larvae.

(2) Ova collected from the stream should be transferred to *hapas* after short intervals instead of piling them for a long time in mud-enclosures in the boats. By this procedure more oxygenated water and space can be provided for the development of the ova.

(3) The ova should be separated as far as possible, from debris and animals before transferring them to *hapas*.

(4) The ova in the net should not be piled in heaps but should be arranged in a layer. It was seen that in one of the *hapas*, where about 60 lakh ova were placed, the owner could get only about 2 lakh larvae while from a *hapa* of the same dimensions and under similar conditions containing about 8 lakh ova, the larvae obtained were more than two lakhs.

(5) Continuous current of water from the river should be set up in the *hapa*, wherever possible.

(6) Below the mosquito netting a sheet of fine cloth should be placed in the *hapa*, as shown in figure 5. By this method all the larvae can be collected in the lower sheet and labour of collecting them from the *hapa* will be saved. Moreover, the larvae which cannot be gathered from the *hapa* and are lost to the collector, will also be saved.

(7) After the collection of ova is over, attempts should be made to collect larvae and fry from the stream. For the collection of larvae and fry the net known at Rajshahi and Murshidabad as '*Benchijal*' can be used. For the figure of this net reference may be made to Rahman (1946).

References

Ahmad, Nazir, 1944—'The spawning habits and early stages in the development of the carp, *Labeo gonius* (Hamilton), with hints for distinguishing eggs, embryos and larvae of *Labeo gonius*, *Cirrhina mrigala* and *Wallagonia attu*. *Proc. Nat. Inst. Sci., India*, X, pp. 343-54.

Khan, Hamid, 1945—'Symposium on the factors influencing the spawning of Indian carps. Observations on the spawning behaviour of carp in the Punjab'.

Majumdar, C.H., 1940—'Spawning grounds and hatcheries in the district
Proc. Nat. Inst. Sci., India, XI, pp. 315-320.
of Chittagong, Bengal'. *Science and Culture*, pp. 735-739.

Mookerjee, H.K., Mazumdar, S.R. and Dasgupta, B.N., 1944—'Observations on the breeding ground and spawning habits of certain Indian Carps in the Midnapore district, Bengal, with suggestions for their breeding, collection of eggs and the rearing of fry'. *Journ. Dept. Sci., Calcutta University*, pp. 81-91.

Rahman, Q.M., 1946—A note on the fish fry trade in Bengal. Government of Bengal, Calcutta, pp. 1-35.

EXPLANATION OF TEXT-FIGURES

Text-fig. 1. Mosquito-curtain used in the river Halda, Chittagong, for collection of eggs.
Text-fig. 2. Sketch map of a portion of the Halda showing spawn collection area.
Text-fig. 3. A typical arrangement of *hapas* in Chittagong.
Text-fig. 4. '*Chang*', used for embryonic development.
Text-fig. 5. A double cloth tank, used for experiments in the Halda.

WILD LIFE PRESERVATION:

INDIA'S VANISHING ASSET

BY

LT.-COL. R. W. BURTON

This contribution to the *Journal* of the Society was in course of preparation when there appeared in the 'Madras Mail' newspaper of 6th January 1948 an article by Mr. D. Dorai Rajan under the caption, 'Preserve India's Wild Life—an appeal for Government action.'

It is well that the first ventilation of this urgently important subject in the public press since the 15th August 1947 should have been put forward by a national of the new India.

Mr. Rajan's plea deals with South India only, so a similar plea with regard to both the dominions into which this sub-continent has been recently divided is now placed before the members of the Bombay Natural History Society—which has been for many years in actual fact an All-India Society—and the readers of the Journal, and through them to the public at large, the Governments of India and of Pakistan ; all the Provincial Governments and rulers of States, and all owners of land.

THE BOMBAY NATURAL HISTORY SOCIETY

For many years the Society, through the medium of its Journal and other attractive publications, has endeavoured to create and stimulate in India an interest in the wild life of the country. During the past sixty years there have appeared in the Journal upwards of fifty longer and shorter articles and editorials on the subject. It was to a great extent owing to the Society that Act XX of 1887, 'An Act for the Preservation of Wild Birds and Game' (passed after nearly 30 years' agitation in the matter), was replaced by 'The Wild Birds and Animals Protection Act (VIII of 1912) which, together with the Indian Forest Act (XIV of 1927) is the basis of all rules in force at the present time.